

Abstract submitted to the 42nd International Conference on Environmental Systems
Hilton San Diego Resort and Spa; San Diego, California
15-19 July 2012

CFD ventilation study for the Human Powered Centrifuge at the International Space Station

Chang H. Son, The Boeing Company, Houston, TX, USA

Abstract

The Human Powered Centrifuge (HPC) is a hyper gravity facility that will be installed on board the International Space Station (ISS) to enable crew exercises under the artificial gravity conditions. The HPC equipment includes a “bicycle” for long-term exercises of a crewmember that provides power for rotation of HPC at a speed of 30 rpm. The crewmember exercising vigorously on the centrifuge generates the amount of carbon dioxide of several times higher than a crewmember in ordinary conditions. The goal of the study is to analyze the airflow and carbon dioxide distribution within Pressurized Multipurpose Module (PMM) cabin. The 3D computational model included PMM cabin. The full unsteady formulation was used for airflow and CO₂ transport modeling with the so-called sliding mesh concept is considered in the rotating reference frame while the rest of the cabin volume is considered in the stationary reference frame. The localized effects of carbon dioxide dispersion are examined. Strong influence of the rotating HPC equipment on the CO₂ distribution is detected and discussed.